CLAIMS

What is claimed is:

1) A capacitive sensor for providing an output representative of a position along a sensing body extending between two electrodes at which an object is proximate the sensing body, the sensor comprising:

two capacitive sensing channels, each channel connected to a respective one of the electrodes, each channel having a respective channel output representative of a respective non-linear response to a capacitive load imposed by the object when the object is proximate the body;

means for operating the two channels synchronously, and

calculation means for receiving the respective outputs from the two channels, for calculating a ratio of a selected linear combination of the outputs of the two channels, the ratio varying linearly with the position of the object, and for supplying the ratio as the output representative of the position.

2) The sensor of Claim 1 wherein the respective output from each of the channels comprises an algebraic difference between a respective first value measured when the object is adjacent the sensing body and a respective second value measured when the object is distal therefrom.

3) The sensor of Claim 1 wherein the object is capacitively coupled to an electrical ground.

4) The sensor of Claim 1 wherein each sensing channel comprises:

a respective sample capacitor having two terminals, one of which is connected to the associated electrode by means not comprising an electric switching element;

three electric switching elements, each of the three switching elements having both a single respective closed state for connecting one of the terminals of the respective sample capacitor

to only one of two different reference voltages, each of the respective switching elements further having a respective open state in which it does not connect the respective one of the terminals to either of the two reference voltages; and

a respective measurement circuit for supplying the respective channel output responsive to a voltage measurement at a selected one of the terminals of the respective sample capacitor.

5) The sensor of Claim 1 further comprising a plurality of electric switching elements, wherein each sensing channel comprises:

a respective sample capacitor having two terminals, one of which is connected to a respective electrode by means not comprising one of the electric switching elements;

at least one respective electric switching element of the plurality thereof for resetting the respective sample capacitor by connecting both of its terminals to a first selected reference voltage; and

at least two additional respective switching elements of the plurality thereof for alternately switching one of the two terminals of the respective sample capacitor to the first selected reference voltage and the second of the two terminals to a second selected reference voltage.

6) The sensor of Claim 1 wherein:

each channel comprises a respective resistor-capacitor pair and means for measuring a parameter change at the associated electrode;

the means for operating the two channels synchronously comprises a controller for controlling at least three electric switching elements; wherein

two of the at least three electric switching elements are operable by the controller to simultaneously connect both of the two electrodes to a first reference voltage; and wherein

at least a third of the at least three electric switching elements is operable to simultaneously

connect a second reference voltage to each resistor-capacitor pair.

7) The sensor of Claim 1 wherein each of the channels comprises a sampling capacitor whose voltage rises in an inverse exponential fashion with a capacitive load.

8) The sensor of Claim 1 wherein the calculation means comprises a microcontroller and the means for operating the channels synchronously comprises a plurality of switching elements controlled by the microcontroller.

9) The sensor of Claim 1 wherein the sensing body comprises two strips of conductive material extending adjacent to each other with a gap therebetween, wherein at least one of the strips tapers along its length.

10) The sensor of Claim 1 wherein the sensing body comprises a single resistor.

11) The sensor of Claim 1 wherein the sensing body comprises a plurality of discrete resistors connected in series.

12) The sensor of Claim 1 wherein the selected combination is a linear combination, so that the ratio varies linearly with the position of the object.

13) A capacitive sensor for sensing a position of an object along a sensing body extending between two electrodes, the sensor comprising:

two sensing channels respectively connected to the two electrodes, each sensing channel comprising:

a respective sample capacitor having two terminals, one of which is connected to the associated electrode by means not comprising an electric switching element;

three electric switching elements, each of the three switching elements having both a single respective closed state for connecting one of the terminals of the respective sample capacitor only to one of two different reference voltages, each of the respective switching elements

further having a respective open state in which it does not connect the respective one of the terminals to either of the two reference voltages; and

a respective measurement circuit for supplying an output responsive to a measurement at a selected one of the terminals of the respective sample capacitor;

a switch controller for selectively opening and closing the switching elements; and

means for calculating the position of the object from the respective outputs of the two measurement circuits.

14) The sensor of Claim 13 wherein the means for calculating the position of the object comprises a microcontroller.

15) The sensor of Claim 13 further comprising means for summing the respective outputs from the two measurement circuits and for providing a detection output if the sum exceeds a stored minimum threshold value.

16) The sensor of Claim 13 wherein the sensing body comprises a single resistor.

17) The sensor of Claim 13 wherein the sensing body comprises a plurality of discrete resistors connected in series.

18) A capacitive sensor for sensing a position of an object along a sensing body extending between two electrodes, the sensor comprising:

a switch controller for selectively closing ones of a plurality of electric switching elements;

two sensing channels having respective inputs from the electrodes and having respective outputs from respective associated measurement circuits, each of the sensing channels comprising

a respective sample capacitor having two terminals, one of which is connected to a

respective electrode by means not comprising one of the electric switching elements;

at least one respective electric switching element of the plurality thereof for resetting the respective sample capacitor by connecting both of its terminals to a first selected reference voltage;

at least two additional respective switching elements of the plurality thereof for alternately switching one of the two terminals of the respective sample capacitor to the first selected reference voltage and the second of the two terminals to a second selected reference voltage; and

a means for calculating the position of the object from the respective outputs of the two measurement circuits.

19) The sensor of Claim 18 wherein the means for calculating the position of the object comprises a microcontroller.

20) The sensor of Claim 18 further comprising means for summing the respective outputs from the two measurement circuits and for providing a detection output if the sum exceeds a selected minimum threshold value.

21) The sensor of any one of Claims 18 wherein the sensing body comprises two strips of conductive material extending adjacent to each other with a gap therebetween, wherein at least one of the strips tapers along its length.

22) The sensor of Claim 18 wherein the sensing body comprises a single resistor.

23) The sensor of Claim 18 wherein the sensing body comprises a plurality of discrete resistors connected in series.

24) A method for measuring a position of an object along a sensing body extending between two electrodes, each of the two electrodes connected to a respective capacitive sensing channel, each of channels comprising a respective sample capacitor having one of its two

terminals connected to a respective one of the two electrodes, each of the channels further comprising a respective measurement circuit having a respective output, the respective measurement circuit connected to a selected one of the two terminals of the respective sample capacitor, the method comprising the sequentially executed steps of:

a) resetting each of the sample capacitors to a respective selected initial state;

b) simultaneously closing respective first switches, each of the first switches respectively associated with only one of the channels, to connect the respective selected terminal of each sample capacitor to a first selected voltage;

d) waiting a selected interval, and then simultaneously opening both of the first switches;

e) closing respective second switches to connect each of the terminals of the respective sample capacitors that is not the respective selected terminal to a respective second selected voltage;

f) measuring, for each channel, by means of the respective measurement circuit, a respective voltage at the respective selected terminal of the respective sample capacitor; and

g) calculating, from the outputs of the two measurement circuits, the position of the object.

25) The method of Claim 24 wherein the step of calculating the position of the object comprises computing a ratio from the outputs of the two measurement circuits.

26) The method of Claim 24 further comprising an additional step of determining, from the outputs of the two measurement circuits, a detection state indication.

27) The method of Claim 24 wherein at least steps b) through e) are repeated a selected number of times before calculating the position of the object.

28) The method of Claim 24 wherein each of the measurement circuits comprises a respective counter.